Zhu Binbin

Growth and fabrication of InGaN/GaN lightemitting diodes from planar to microwall structures: epitaxial and device designs, modelling and characterization

The thesis has studied the InGaN/GaN-based LEDs, from growth to fabrication and from planar structure to micro-wall structure, to alleviate their efficiency droop and improve their performance. For the epi-wafers, extraordinary performance is observed in tandem LEDs, which is attributed to reduced forward voltage and more uniform carrier distribution, while reduced forward voltage and improved electrical thermal stability are observed in LEDs with Mg doping in the barriers, which are due to reduced depletion length and increased acceptor concentration. For the fabricated devices, the reflective contact is studied, in which the decoupled contact is introduced and InGa$_x$N$_y$O$_z$ interfacial layer is designed, while both methods help realize ohmic contact and high reflectivity. In addition, GaN micro-walls are prepared by selective area growth method and micro-wall LEDs are realized. This thesis has performed systematic study on LEDs, and improved performance is realized in three aspects, which are growth, fabrication and epi-wafer structures.

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